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QUALIFICATION TESTING OF THE SMARTVAULT HOUSEHOLD GOODS SHIPPING CONTAINER

403 SCMS/GUEB
AIR FORCE PACKAGING TECHNOLOGY & ENGINEERING FACILITY
WRIGHT PATTERSON AFB, OH 45433-5540
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NOTICE

AFPTEF PROJECT NO. 10-P-105
TITLE: Qualification Testing of the SmartVault Household Goods Shipping Container

ABSTRACT

The Air Force Packaging Technology Engineering Facility (AFPTEF) was tasked to perform qualification testing of the SmartVault Container, manufactured by Smart Move Transportation, LLC, for the U.S. Army Surface Deployment and Distribution Command (SDDC) approval for use as a military household goods container. This container was tested by AFPTEF in 2008 and did not meet test requirements, chiefly due to a lack of water-tightness. However, Smart Move has since developed a new sealing procedure for the container and requested that the container be re-tested.

Tests were performed in accordance with SDDC Pamphlet No. 55-12, ASTM D4169, Distribution Cycle 18 and MIL-STD-810G. Although the SmartVault container's latches had a tendency to slip out of place, the door remained closed during testing and otherwise successfully met all test requirements. This report will be furnished to the SDDC and Smart Move for their use in determining approval of the SmartVault container for transportation of household goods.

Total man-hours: 185

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INTRODUCTION

BACKGROUND – In 2008, AFPTEF performed qualification testing of the SmartVault container, designed by Smart Move Transportation, LLC, in accordance with the requirements of the U.S. Army Surface Deployment and Distribution Command (SDDC), for approval as a household goods (HHG) shipping container. The SDDC requires all HHG containers to be tested, used, and approved in accordance with SDDC Pamphlet No. 55-12. The SmartVault container failed to meet requirements in 2008 chiefly due to a lack of water-tightness; this was the result of inadequate panel seam sealing and loosening of the wall/base interface during testing.

In 2010, AFPTEF was requested to re-test the SmartVault container as Smart Move believed they had corrected the previous design and construction deficiencies. As a plastic container used to transport military HHG, the SmartVault would be virtually unique as a plastic container, since HHG containers are generally made from wood or fiberboard.

REQUIREMENTS – SDDC Pamphlet 55-12, Transportation and Travel Commercial Containers for Department of Defense Household Goods Shipments, defines container performance criteria (specific ASTM D4169, DC-18, Assurance Level II and MIL-STD-810G tests, test temperatures/relative humidities(RH)), carrier/container manufacturer and personal property shipping offices responsibilities, criteria for the use of containers (markings, sealing and reinforcing) and container inspection, and lists SDDC approved containers. The required ASTM D4169, DC-18 and MIL-STD-810G tests, at temperatures and RH required for plastic containers, are as follows:

- Rain test, MIL-STD-810G, Procedure II (ambient temperature)
- Forklift truck transport test (ambient temperature)
- Rotational cornerwise and edgewise (ambient temperature)
- Warehouse stack test (+125ºF/95% RH)
- Repeat Forklift and Rotational drops at (+125ºF/95% RH)
- Loose-load vibration test (ambient temperature)
- Repeat Forklift and Rotational drops (-30ºF)
- Repeat Rain test, MIL-STD-810G, Procedure II (ambient temperature)

(The Tip Test was not performed by determination of SDDC as unnecessary for this container.)

CONTAINER DESIGN – The SmartVault container (Appendix 2, Figures 1 - 7) consists of an aluminum base with 4-way forklift entry and molded high-density polyethylene (HDPE) ribbed walls and (translucent) lid which are held together with stainless steel bolts. Container walls fit into a channel on the upper edge of the pallet base and are held in place with stainless steel bolts that go through the channel and wall. The hinged door is secured using recessed plastic latches which slide through the door edge and insert into blind openings in the doorframe (Appendix 2, Figure 8); these are held in place by handle

tabs that snap into notches (Appendix 2, Figure 9) and are in the fully open position when in the second (farthest from door edge) groove. A lockable steel slide-bolt slips into place behind the center vertical latch (latch 4, Appendix 2, Figure 2 & 9) and can be padlocked to prevent casual pilferage. There is an additional hole in the door edge which corresponds to a hole in the doorframe, and can be used as a secondary locking location.

This container is intended to be watertight, but not airtight. RTV-sealant was applied to component interfaces and seams before assembly to prevent water entry, and non-continuous adhesive-backed gaskets of various types were applied around the doorway (Appendix 2, Figures 10 - 13). Two black, and one white, foam gasket strips extend across the front face and bottom edge, respectively, of the top doorjamb. One white, and one black, foam gasket strips extend down the front face and inside edge, respectively, of the hinged side door jamb. Two white, and one white, foam gasket strips extend down the front face and inside edge, respectively, of the latched side doorjamb. One white foam gasket strip extends across the front face and bottom edge of the bottom doorsill.

Stainless steel tubes (Appendix 2, Figures 14 & 15) set into the inner ribs of the side walls provide interior strapping tie-down locations. These tubes are too close to the wall and ribbing to allow use of the larger tie-down straps commonly used in the military (Appendix 2, Figures 36 & 37), and require use of smaller commercial-off-the-shelf tie-down straps (provided by Smart Move).

The container tare weight is 929 pounds. The gross weight as tested is 2995 lb, with a test load weight of 2066 lb. External dimensions are 90 in. (length) x 76 in. (width) x 88 in. (height); internal dimensions are 83 in. x 70 in. x 78 in. The door opening measures 40 in. (width) x 71.5 in. The aluminum pallet base is 8 inches high at the edges, and 7 inches high (inner floor surface). The forklift openings on the narrower ends are approximately 18 inches wide, 3 inches high and 18 inches apart. Forklift openings on the longer sides are approximately 21.75 inches wide, 3 inches high and 12 inches apart. The bottom edges of all forklift openings are beveled (Appendix 2, Figure 16).

SMARTVAULT CONTAINER FEATURES	
Forkliftable	Yes
Door Latches	7
Lockable Slide-bolt	1
Additional Locking Location	1
Lift Rings	None
Base Tie-down Rings	None
Internal Wall Tie-down Points	Yes
Stacking Capability	Yes

QUALIFICATION TESTING

TEST SAMPLE – Smart Move provided one complete SmartVault container described above and one aluminum SmartVault container base to AFPTEF for testing. Loading

instructions are provided with each SmartVault as permanent adhesive labels on an inner wall. SmartVaults are provided completely assembled.

Each face of the container was uniquely identified for testing identification as shown below.

DESIGNATED SIDE	CONTAINER FEATURE
Top	Top
Forward	Door Opening
Aft	End Opposite Door
Right	Right Side from Aft
Left	Left Side from Aft
Bottom	Base Bottom

In addition, the seven latches were numbered, in counter-clockwise order, starting with the upper hinge-side corner of the door as latch 1 (Appendix 2, Figure 2).

TEST LOAD – The test load consisted primarily of iron weights and foam dunnage in closed wood boxes, with an average weight per box of 245 lb. This load was evenly distributed over the container floor with six boxes placed along the container walls and held in place with supplied cargo straps that were hooked to the internal tiedowns; a seventh box was placed in the center of the container floor and wedged in place with wood bracing (Appendix 2, Figures 17 -19). The center of gravity for this test load was approximately 1.5 feet off the floor of the container (this is lower than required by SDDC Pam. 55-12, but was approved by SDDC for this test). The test load weight was 2066 pounds, and the tested gross container weight was 2995 pounds.

TEST PLAN – The test plan primary references were SDDC Pamphlet 55-12 and ASTM D 4169, Assurance Level II (Appendix 1). The methods specified in the test plan constituted the procedure for performing the container testing. The performance criteria for evaluation of container acceptability were specified as no structural damage, deformation or degradation of the container or components, or movement of the components, that would permit spillage of or damage to contents, prevent installation of components, reduce container strength or cause stacking instability, permit water entry, adversely affect safety during transport or storage, or otherwise interfere with forklifting or container use. Test temperatures and relative humidity are those specified in SDDC Pam. 55-12 for plastic containers. These tests are commonly applied to shipping containers used to transport HHG in the military distribution environment. The Tip Test was not performed by determination of SDDC as unnecessary for this container. All tests were performed at AFPTEF, Building 70, Area A, Wright-Patterson AFB.

ITEM INSTRUMENTATION – No data recording instrumentation was used in the testing below. See Appendix 3 for other test instrumentation information.

TEST SEQUENCES – Note: All test sequences were performed on one container with test load (above) except as noted in the test procedure.

TEST SEQUENCE 1 – Rain, Ambient Temperature

Procedure – The empty container was used for this test to permit complete inspection and observation of all interior surfaces and components. In accordance with MIL-STD-810G, 506.5, Procedure II (modified as described), the container was placed on a level surface and a large-droplet spray pattern of water (municipal water pressure 40 psig & ambient temperature) was applied to all container surfaces, using only one nozzle. Water was applied from a distance of 3 ft to 4 ft. The total test period was reduced to 45 minutes with the hose spray applied to each side for approximately 10 minutes, and focused primarily on seams and the edges of openings (Appendix 2, Figure 20). The interior was then examined for water incursions.

Results – At the end of the test period, no water was found in the container. There was no evidence of leakage past the door gaskets, nor any droplets at any of the wall/roof, wall/wall or wall/base interfaces.

TEST SEQUENCE 2 – Forklift Truck Transport Test, Ambient Temperature

Procedure: The container was picked up by the tine openings on the aft side and driven over the test course 1 round trip (forward and backward) (Appendix 2, Figure 21). The container was placed on the ground, picked up on an adjacent side, and again driven over the test course 1 round trip.

Results: There was no instability, weakening of, or damage to any component of the container. The container met test requirements.

TEST SEQUENCE 3 – Rotational Drops, Ambient Temperature

Procedure – An Assurance Level II drop height of 9 inches was used to perform four corner and four edge drops of the container onto a smooth concrete surface (Appendix 2, Figure 22). The container was visually inspected for damage.

Results – Upon conclusion of testing, latches 2, 3 and 4 had partially released, coming out of the first locking groove (Appendix 2, Figures 29 & 30). These latches began their releases throughout the drops, and were not put back into place during testing. The latches otherwise remained in place, and the edges and corners of the door remained closed. There was no other movement or shifting of container components, and no instability, weakening of, or damage to any component of the container. Other than the described movement of the three latches, the container met test requirements.

TEST SEQUENCE 4 – Warehouse Stacking, +125ºF & 95 % Relative Humidity

Procedure – A 7377 lb stack test weight, consisting of one identical aluminum container pallet base with steel and iron weights, was placed on top of the container. The container, with the test load, was placed in an environmental

chamber for 24 hours at the above temperature and humidity (Appendix 2, Figure 23). At the end of the test period, the weight was removed from the container and the container was visually inspected.

Results – There was no damage or deformation of the container. The container met the test requirements.

TEST SEQUENCE 5 – Forklift Truck Transport Test, +125ºF & 95 % Relative Humidity

Procedure: The container was conditioned for 24 hours in an environmental chamber at the above temperature and humidity. At the end of this period, the container was removed from the chamber by the tine openings on the forward (door) side and Test Sequence 2 was repeated; the container was picked up on the left side for the second round trip over the test course (Appendix 2, Figure 24).

Results: There was no instability, weakening of, or damage to any component of the container. The container met test requirements.

TEST SEQUENCE 6 – Rotational Drops, +125ºF & 95 % Relative Humidity

Procedure – The container was conditioned for 24 hours in an environmental chamber at the above temperature and humidity. At the end of this period, Test Sequence 3 was repeated (Appendix 2, Figure 25). The container was visually inspected for damage.

Results – Upon conclusion of testing, latch 3 had partially released, coming out of the first locking groove; latches 1 & 2 had completely released (Appendix 2, Figures 31 & 32). These latches began their releases throughout the drops, and were not put back into place during testing. The latches otherwise remained in place, and the edges and corners of the door remained closed. There was no other movement or shifting of container components, and no instability, weakening of, or damage to any component of the container. Other than the described movement of the three latches, the container met test requirements.

TEST SEQUENCE 7 – Loose Load Vibration Test, Repetitive Shock

Procedure – A sheet of 3/4-inch plywood was bolted to the top of the vibration table, and the container was placed on the plywood. Restraints were used to prevent the container from sliding off the table. The container was allowed approximately 1/2-inch unrestricted movement in the horizontal direction from the centered position on the table (Appendix 2, Figure 26).

The table frequency was increased from 3.5 Hz until the container left the table surface (approximately 3.65 Hz). At one-inch double amplitude, a 1/16-inch-thick flat metal feeler could be slid freely between the tabletop and the container under all points of the container. Repetitive shock testing was conducted for 2 hours at ambient temperature.

Results - The loaded container was vibrated at 3.65 Hz for 2 hours. At the end of testing there was no visible damage to the container and all components had remained in place. The container met the test requirements.

TEST SEQUENCE 8 – Forklift Truck Transport Test, -30ºF

Procedure: The container was conditioned for 24 hours in an environmental chamber at the above temperature. At the end of this period, the container was removed from the chamber by the tine openings on the aft side and Test Sequence 2 was repeated; the container was picked up on the right side for the second round trip over the test course (Appendix 2, Figure 27).

Results: There was no instability, weakening of, or damage to any component of the container. The container met test requirements.

TEST SEQUENCE 9 – Rotational Drops, -30ºF

Procedure – The container was conditioned for 24 hours in an environmental chamber at the above temperature. At the end of this period, Test Sequence 3 was repeated (Appendix 2, Figure 28). The container was visually inspected for damage.

Results – Upon conclusion of testing, latches 1, 6 & 7 had partially released, coming out of the first locking groove; latch 2 had completely released (Appendix 2, Figures 33 - 35). These latches began their releases throughout the drops, and were not put back into place during testing. The latches otherwise remained in place, and the edges and corners of the door remained closed. There was no other movement or shifting of container components, and no instability, weakening of, or damage to any component of the container. Other than the described movement of the three latches, the container met test requirements.

TEST SEQUENCE 10 – Rain, Ambient Temperature

Procedure – The container was emptied immediately prior to this test to permit complete inspection and observation of all interior surfaces and components during the test. Test Sequence 1 was immediately repeated and the interior was examined for water incursions during and after the test (Appendix 2, Figure 20).

Results – At the end of the test period, no water was found in the container. There was no evidence of leakage past the door gaskets, nor any droplets at any of the wall/roof, wall/wall or wall/base interfaces.

NOTE: For informational purposes only, this test was repeated 2 weeks later at 45ºF ambient temperature. Although not as cold as Test Sequence 9 (-30ºF), the door gasketing had again taken a set from the pressure of the door, which remained even when the door was opened and at the test's conclusion. Prior to testing, in order to simulate the partial and full releases which resulted from the rotational drop tests, latch 1 was slipped out of the first groove and latch 2 was fully released; latch 3 was fully released and latch 4 (locking latch) was fully closed; latches 5 and 6 were fully open, and latch 7 was

slipped out of the first groove. The water spray was applied as described above to the door edges. The door was opened and the interior examined. There was no water in the container interior.

TEST CONCLUSIONS – There was no structural damage, deformation or degradation of the container or components, or movement of the components, that permitted spillage of or damage to contents, prevented installation of components or closure of latches, reduced container strength or caused stacking instability or water entry, or would adversely affect safety during transport or storage, or interfere with forklifting or container use. Although slippage of various door latches occurred due to the force of rotational impacts, the door remained closed and no water entry occurred following the conclusion of all other testing (during Test Sequence 10, Rain). Very light condensation (not water incursion) was observed along the roof/wall seams following Test Sequence 10, where thicker portions of the container were still colder than ambient temperatures. Despite the gasketing holding a 'set' from the pressure of the door prior to the repeat of Test Sequence 10, there was no water entry even with latches loosened or open. Other than the described movement of the latches, the container met test requirements.

CONCLUSIONS & RECOMMENDATIONS

The SmartVault container met all functional test requirements. There are, however, several areas of concern that should be addressed by SDDC to ensure that all Smartvaults used for military HHG shipments perform as well as the tested container indicates they should.

As noted above, the door latches are prone to partial and full releases during rough handling; combined with the set that the doorway gaskets can take, this could result in water entry around the door edges in actual use. We recommend that Smart Move consider modifying the door latch design to reinforce each latch's closure and prevent inadvertent releases.

Gasket type, placement, and performance specifications must be fully documented to ensure that they perform in a consistent manner in the military HHG shipping environment and can be replaced with equivalent products. Gaskets, especially those across the bottom of the door opening, are extremely vulnerable to damage from feet and items being dragged across it; therefore, a regular inspection & replacement schedule (which may be adjusted based on future experience) should be set to ensure that the materials are correctly replaced as they are damaged or age.

We also suggest that SDDC obtain all technical data for sealing, assembly and installation procedures (including sealant specifications) and any replaceable parts, to ensure repeatable results and reliable containers for potential container users other than Smart Move. This documentation is especially important for any containers that may end up in the military distribution environment where they cannot be replaced or refurbished by Smart Move.

We recommend that SDDC carefully monitor the real-life performance of the SmartVault container for at least one year to ensure that any problems with units used to transport military HHG are fully identified and addressed, and to verify that sealing and gasket materials and hardware continue to meet performance specifications.

APPENDIX 1: Test Plan

AF PACKAGING TECHNOLOGY AND ENGINEERING FACILITY (Container Test Plan)					**AFPTEF PROJECT NUMBER:** 10 -P-105	
CONTAINER SIZE (L x W x D) (IN) **INTERIOR:**	**EXTERIOR:**	**WEIGHT (LB)** **GROSS:**	**TARE:**	**CUBE (CU. FT)**	**QUANTITY:**	**DATE:**
83 X 70 X 78	90 X 76 X 88	2995	929	Approx 348	1 + 1 base	Nov 10
ITEM NAME: Household Goods				**MANUFACTURER:** Smart Move Transportation, LLC		
CONTAINER NAME: SMARTVAULT					**CONTAINER COST:**	
PACK DESCRIPTION: Wood & fiberboard boxes, iron weights, polyethylene foam and wood, totaling 2000 lb						
CONDITIONING: Ambient, +125ºF/95%RH, -30ºF						

TEST NO.	**REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S**	**TEST TITLE AND PARAMETERS**	**CONTAINER ORIENTATION or CONDITIONING**	**INSTRU-MENTATION**

PASS/FAIL CRITERIA FOR ALL TESTS

There shall be no damage, deformation or degradation of the container or components that would permit spillage of or damage to contents, prevent installation of components, reduce container strength or cause stacking instability, permit water entry, adversely affect safety during transport or storage, interfere with forklifting or container use. All components shall remain in place throughout testing.

The required tests below are in accordance with (draft) SDDC Pamphlet No. 55-12, Section III.

1.	**Product examination.** **Manufacturer product specifications.**	Fully assembled container shall be weighed, measured, and all components, assembly and closure requirements examined for compliance with manufacturer instructions and documentation. Interface with tiedown straps shall be checked.	Ambient temp.	Visual Inspection (VI), tape measure; Scale
1a.	**Test Load Description.** **SDDC No. 55-12, para. 3002.**	Test load consists of wood & fiberboard boxes, &/or drums, filled with iron weights, wood blocks, and foam/loosefill absorbent as needed to ensure a total load of **2000 lb**. Polyethylene foam wedged between the containers & tiedown straps, or wood blocking/bracing shall be used to prevent load shifting.	Ambient temp.	Visual Inspection (VI), tape measure; Scale

COMMENTS:

PREPARED BY:	**APPROVED BY:**
Susan J. Evans, Mechanical Engineer	Robbin L. Miller, Chief AFPTEF

AF PACKAGING TECHNOLOGY AND ENGINEERING FACILITY (Container Test Plan)					**AFPTEF PROJECT NUMBER:** 10 -P-105	
CONTAINER SIZE (L x W x D) (IN) **INTERIOR:** 83 X 70 X 78	**EXTERIOR:** 90 X 76 X 88	**WEIGHT (LB)** **GROSS:** 2995	**ITEM:** 929	**CUBE (CU. FT)** Approx 348	**QUANTITY:** 1 + 1 base	**DATE:** Nov 10
ITEM NAME: Household Goods				**MANUFACTURER:** Smart Move Transportation, LLC		
CONTAINER NAME: SMARTVAULT					**CONTAINER COST:**	
PACK DESCRIPTION: Wood & fiberboard boxes, iron weights, polyethylene foam and wood, totaling 2000 lb						
CONDITIONING: Ambient, +125ºF/95%RH, -30ºF						

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION or CONDITIONING	EQUIPMENT & INSTRUMENTATION
	Rain Test, Ambient Temperature, Assurance Level II			
2.	**Rain.** **MIL-STD-810G, Method 506.5, Procedure II.**	Procedure shall be modified as follows: With container empty or loaded, and on a level surface, a large-droplet spray pattern of water (municipal water pressure 40 psig & ambient temperature) shall be applied to all container surfaces, using only one nozzle. Water shall be applied from a distance of 3 ft to 4 ft. Total test period shall be reduced to 45 minutes with the hose spray applied to each side for approximately 10 minutes, and focused primarily on seams and the edges of openings. The interior shall then be examined for water incursion. Entry of more than a few drops of water shall be a test failure.	Ambient temp.	Hose, standard "municipal" water pressure.
	Schedule A – Handling - Manual & Mechanical, Assurance Level II			
3.	**Forklift Truck Transport Test.** **ASTM D4169, Sched. A, para. 10.3.3(2), DC-18 ASTM D6055, Method A, 2 cycles.**	Lay 3 pairs of 1 in. x 6 in. boards on 100-ft test course at 30, 60, and 90 feet. Angle boards to the forklift's path at 90º, 60º, and 75º respectively; the left wheel striking 1st over the second board pair, the right wheel 1st over the 3rd pair. Pick up container by the tine openings on a side and drive over course 1 rd trip. Pick up container on an adjacent side and repeat.	Ambient temp.	Fork-lift, boards, timer, tape measure.

COMMENTS:	
PREPARED BY: Susan J. Evans, Mechanical Engineer	**APPROVED BY:** Robbin L. Miller, Chief AFPTEF

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CONTAINER NAME: SMARTVAULT					**CONTAINER COST:**	
PACK DESCRIPTION: Wood & fiberboard boxes, iron weights, polyethylene foam and wood, totaling 2000 lb						
CONDITIONING: Ambient, +125ºF/95%RH, -30ºF						

TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION or CONDITIONING	EQUPMENT & INSTRUMENTATION
	Schedule A – Handling - Manual & Mechanical, Assurance Level II, continued			
4.	**Rotational (cornerwise & edgewise) Drops.** **ASTM D4169, Sched. A, para. 10.3.3(3), DC-18, ASTM D6179 Methods A&B.**	Drops shall be performed on all edges and corners, using a 9" drop height. 6-in. and 12-in. wood edge & corner supports shall be used as needed. One drop shall be performed on each edge and corner.	Ambient temp.	Support blocks, hoist, quick-release, cargo straps, tape measure.
	Schedule B – Warehouse Stacking, High Temperature & Rel. Humidity			
5.	**Stack Test.** **ASTM D4169, Schedule B, para. 11, DC-18.**	The container with test load shall be placed in an environmental chamber at the required conditions. An identical container base, with a minimum load of 7377 lb, shall be placed on top of the test container and left in place for 24 hours. The container shall be examined for damage at the end of 24 hours. Test Load = Container Gross Mass*[(16 feet-container height)/container height]*(Safety Factor 2)	+125ºF & 95 % RH (16 ft – 7.17 ft)/7.17ft (2)(gross mass of container) = 7377 lb	Environmental chamber, forklift, iron weights.

COMMENTS:

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Susan J. Evans, Mechanical Engineer	Robbin L. Miller, Chief AFPTEF

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TEST NO.	REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S	TEST TITLE AND PARAMETERS	CONTAINER ORIENTATION or CONDITIONING	EQUPMENT & INSTRUMENTATION
	Schedule A – Handling - Manual & Mechanical, High Temp. and RH, Assurance Level II			
6.	**Forklift Truck Transport Test.** **ASTM D4169, Sched. A, para. 10.3.3(2), DC-18 ASTM D6055, Method A, 2 cycles.**	After conditioning at the specified temp. & humidity for 24 hours, the container with test load shall be removed from the environmental chamber and test sequence 3 repeated.	+125ºF & 95 % RH	Environmental chamber, fork-lift, boards, timer, tape measure.
7.	**Rotational (cornerwise & edgewise) Drops.** **ASTM D4169, Sched. A, para. 10.3.3(3), DC-18, ASTM D6179 Methods A & B.**	After conditioning at the specified temp. & humidity for 24 hours, the container with test load shall be removed from the environmental chamber and test sequence 4 repeated.	+125ºF & 95 % RH	Support blocks, hoist, quick-release, tape measure, cargo straps.
	Schedule F – Loose Load Vibration, Assurance Level II			
8.	**Vehicle Vibration.** **ASTM D4169, Sched. F, para. 13.3, DC-18 ASTM D999, Method A1.**	Container with test load shall be tested as described with a dwell time of 2 hours, in one position.	Ambient temp.; upright shipping position.	Vibration table, controller.

COMMENTS:	
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TEST NO.	**REF STD/SPEC AND TEST METHOD OR PROCEDURE NO'S**	**TEST TITLE AND PARAMETERS**	**CONTAINER ORIENTATION or CONDITIONING**	**INSTRU-MENTATION**
	Schedule A – Handling - Manual & Mechanical, Low temperature, Assurance Level II			
9.	**Forklift Truck Transport Test.** **ASTM D4169, Sched. A, para. 10.3.3(3), DC-18, ASTM D6179 Methods A & B.**	Condition at the specified temperature for 24 hours (min.), the container with test load shall be removed from the environmental chamber and test sequence 3 repeated.	-30ºF	Environmental chamber, fork-lift, boards, timer, tape measure.
10.	**Rotational (cornerwise & edgewise) Drops.** **ASTM D4169, Sched. A, para. 10.3.3(2), DC-18 ASTM D6055, Method A, 2 cycles.**	After conditioning at the specified temperature for 24 hours, the container with test load shall be removed from the environmental chamber and test sequence 4 repeated.	-30ºF	Support blocks, hoist, quick-release, tape measure, cargo straps.
	Rain Test, Low Temperature, Assurance Level II			
11.	**Rain.** **MIL-STD-810G, Method 506.5, Procedure II.**	Immediately following Test No. 10, the container with test load shall be placed on a level surface (and, if possible, in a chamber cooled to -30ºF), and test sequence 2 repeated.	-30ºF	Hose, standard "municipal" water pressure.

COMMENTS:

PREPARED BY:	**APPROVED BY:**
Susan J. Evans, Mechanical Engineer	Robbin L. Miller, Chief AFPTEF

APPENDIX 2: Container and Testing Photographs

Figure 1. SmartVault container – forward view.

Figure 2. SmartVault container – forward view with counterclockwise door latch numbering system.

Figure 3. Container interior, showing molded walls and aluminum floor.

Figure 4. Interior view of container roof.

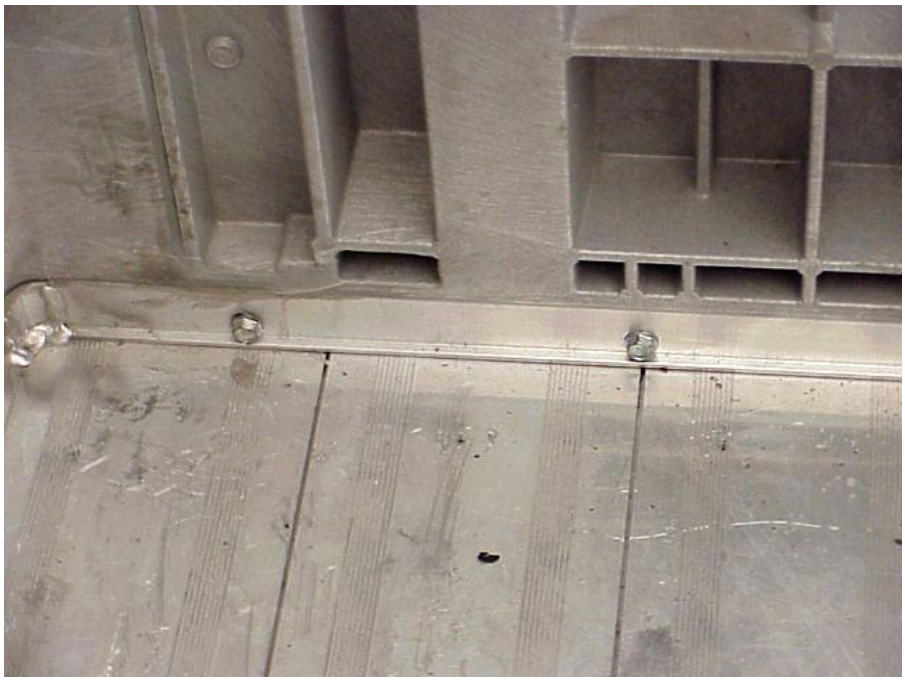

Figure 5. Wall/base interface, near a corner.

Figure 6. Doorway – hinge side.

Figure 7. Doorway – latching side; note blind openings for latch insertion.

Figure 8. Blind openings for latch insertion; hole above for second lock.

Figure 9. Latch 4 with lockable slide-bolt; note hole above latch for 2nd lock or seal.

Figure 10. Upper doorway gaskets; note blind openings for latch insertion.

Figure 11. Hinge side door gaskets. Note overlap of upper doorway gaskets in corner; compression set & grooving of gaskets from door pressure is visible.

Figure 12. Latching side door gaskets, bottom corner.

Figure 13. Doorsill gaskets, hinge corner. Note slight damage to horizontal gasket.

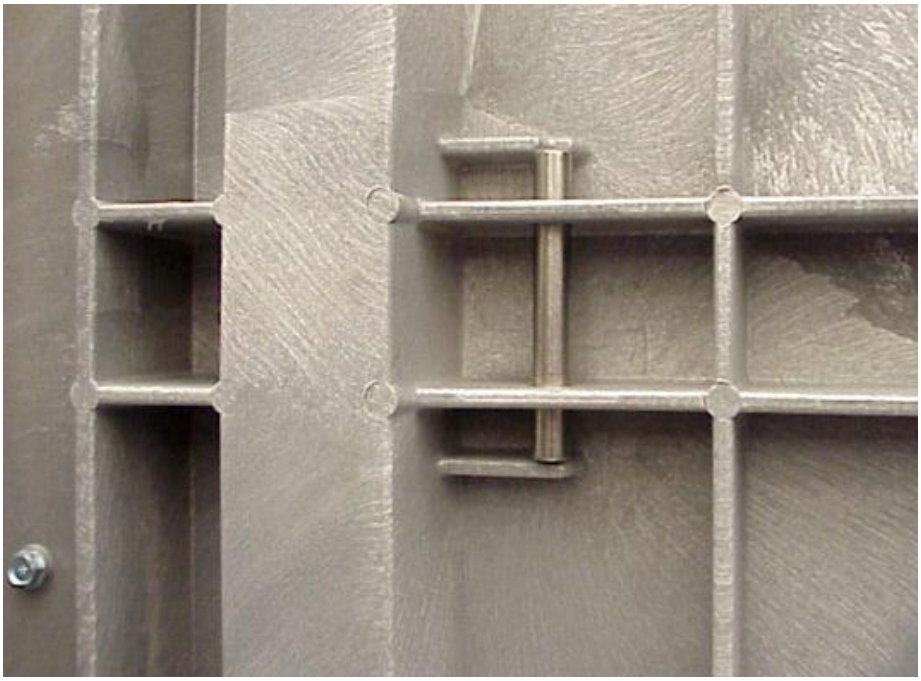

Figure 14. Internal tiedown point.

Figure 15. Internal tiedown points with Smart Move-provided cargo straps.

Figure 16. Forklift openings.

Figure 17. Test load arrangement, right side.

Figure 18. Test load arrangement, left side.

Figure 19. Test load arrangement, forward view.

Figure 20. Rain test.

Figure 21. Forklift transport test, ambient.

Figure 22. Rotational cornerwise drop, ambient.

Figure 23. Stack test, +125ºF & 95% RH.

Figure 24. Forklift transport test, +125ºF & 95% RH.

Figure 25. Rotational edgewise drop test, +125ºF & 95% RH.

Figure 26. Vibration test, ambient.

Figure 27. Forklift transport test, -30ºF.

Figure 28. Rotational cornerwise drop test, -30ºF.

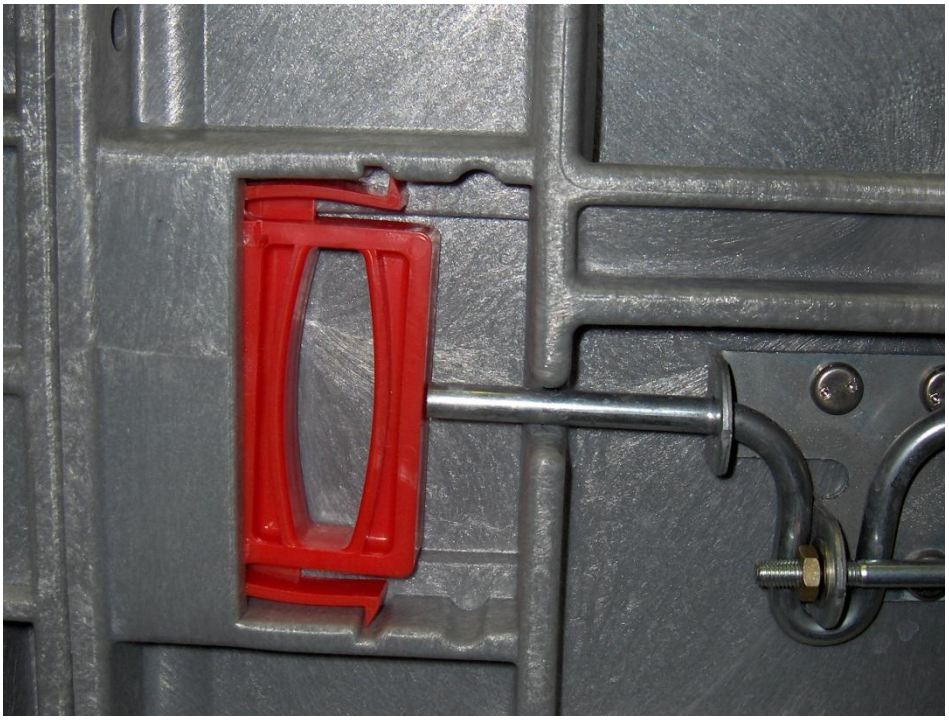

Figure 29. Slippage of (locking) latch 4 due to impacts from ambient rotational drops.

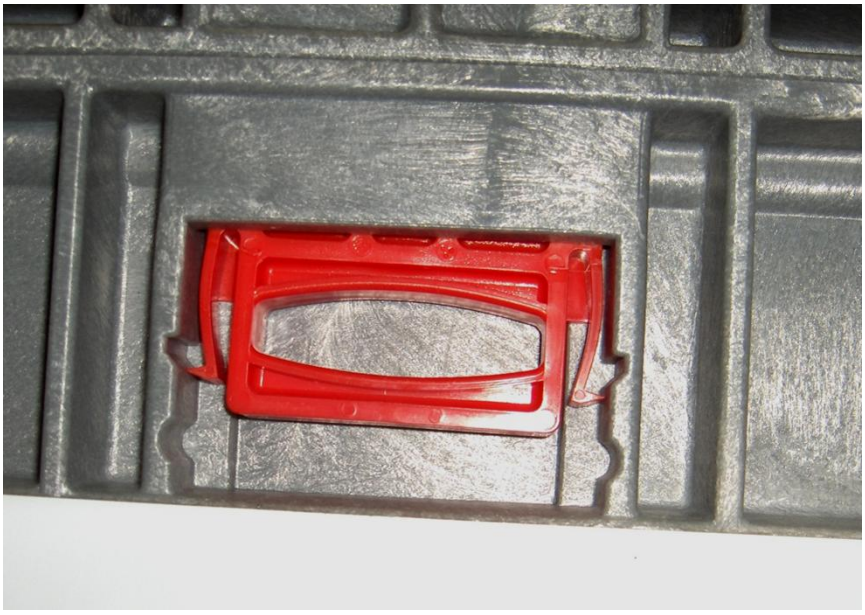

Figure 30. Typical slippage of latches along upper door edge due to impacts from ambient rotational drops. Note upper door edge remains closed.

Figure 31. Slippage of latches 1 &2 due to impacts from high temperature rotational drops.

Figure 32. Slippage of latch 3due to impacts from high temperature rotational drops.

Figure 33. Slippage of latch 2 due to impacts from low temperature rotational drops.

Figure 34. Slippage of latch 6 due to impacts from low temperature rotational drops.

Figure 35. Slippage of latch 7 due to impacts from low temperature rotational drops.

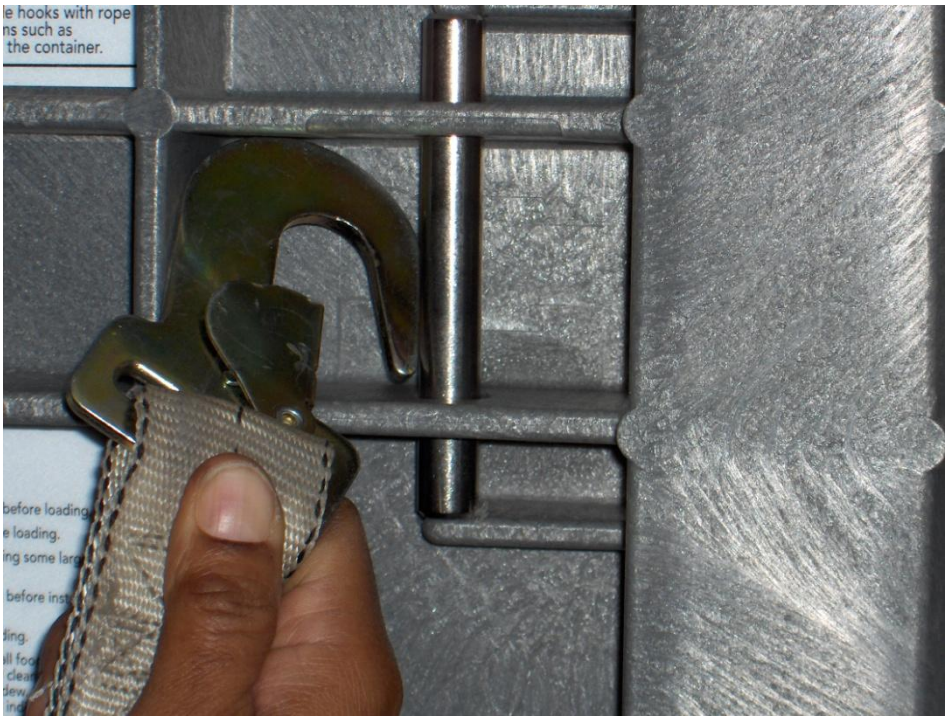

Figure 36. Internal tie-down point and standard tie-down strap hook.

Figure 37. Internal tie-down point and standard tie-down strap hook.

APPENDIX 3: Test Instrumentation

VIBRATION TEST EQUIPMENT - Test sequence 7

EQUIPMENT	MANUFACTURER	MODEL	SN	CAL. DATE
Servohydraulic Vibration Machine	Team Corp.	Special	1988	N/A
Feedback Hardware Controller	Vibration Research	VR8500-2 Vibration Controller	1FC3B4	Sep 10
Feedback Software Controller	Vibration Research	Version 8.0	N/A	N/A
Table Feedback Accelerometer	PCB	T352M193	87131	Apr 10

APPENDIX 4: Distribution List

DISTRIBUTION LIST

DTIC/O
DEFENSE TECHNICAL INFORMATION CENTER
FORT BELVOIR VA 22060-6218

SDDCTEA SDTE-DPE
ATTN MICHAEL S BARTOSIAK
709 WARD DRIVE BLDG 1990
SCOTT AFB IL 62225

SMART MOVE TRANSPORTATION L.L.C.
ATTN STEVE HERMANN
P. O. BOX 99
EVANSVILLE, IN 47701

403 SCMS/CL
5215 THURLOW ST, STE 4
BLDG 70C
WRIGHT-PATTERSON AFB OH 45433-5547

418 SCMS/GULAAA
ATTN THELMA LOOCK
7973 UTILITY DR
BLDG 1135
HILL AFB UT 84056

420 SCMS/GUMAA
ATTN CHAD TROTTER
7701 ARNOLD ST
BLDG 1, RM 112
TINKER AFB OK 73145

406 SCMS/GUMA
ATTN SHEILA MOORE
375 PERRY ST
BLDG 255
ROBINS AFB GA 31098

APPENDIX 5: Report Documentation

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE (DD-MM-YYYY)	2. REPORT TYPE	3. DATES COVERED (From - To)
06-01-2011	Technical Final Project Report	September 2010 - January 2011

4. TITLE AND SUBTITLE
Qualification Testing of the SmartVault Household Goods Shipping Container

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
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5d. PROJECT NUMBER
10-P-105

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Packaging Technology & Engineering Facility
402 SCMS/GLEB
Wright-Patterson AFB OH 45433-5540

8. PERFORMING ORGANIZATION REPORT NUMBER
10-R-03

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Military Surface Deployment & Distribution Command
Transportation Engineering Agency
(Michael S. Baginski)
709 Ward Drive Bldg 1990
Scott AFB IL 62225

10. SPONSOR/MONITOR'S ACRONYM(S)
SDDCTEA SDTE-IPE

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
DISTRIBUTION STATEMENT A

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The Air Force Packaging Technology Engineering Facility (AFPTEF) was tasked to perform qualification testing of the SmartVault Container, manufactured by Smart Move Transportation, LLC, for the U.S. Army Surface Deployment and Distribution Command (SDDC) approval for use as a military household goods container. This container was tested by AFPTEF in 2008 and did not meet test requirements, chiefly due to a lack of water-tightness. However, Smart Move has since developed a new sealing procedure for the container and requested that the container be re-tested.

Tests were performed in accordance with SDDC Pamphlet No. 55-12, ASTM D4169, Distribution Cycle 18 and MIL-STD-810G. Although the SmartVault container's latches had a tendency to slip out of place, the door remained closed during testing and otherwise successfully met all test requirements. This report will be furnished to the SDDC and Smart Move for their use in determining approval of the SmartVault container for transportation of household goods.

15. SUBJECT TERMS
AFPTEF, SDDC, Smart Move, SmartVault, household goods, HHG, plastic container

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Susan J. Evans
U	U	U	UU	44	19b. TELEPHONE NUMBER (Include area code) 937-257-7445

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